EXPOSURE TO PM2.5 AND CAUSE-SPECIFIC MORTALITY RISK IN ADDITIONAL FOLLOW-UP OF THE HARVARD SIX CITIES STUDY: IDENTIFICATION OF SUSCEPTIBLE SUB-POPULATIONS

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Background and Aims: Long-term exposures to particulate matter < 2.5 microns ($PM_{2.5}$) have consistently been associated with increased mortality. Effect modification by gender, socioeconomic status, obesity and smoking has been suggested in many studies. We assessed effect modification of the $PM_{2.5}$ and cause-specific mortality associations in the Harvard Six Cities Study.
Methods: The Harvard Six Cities adult cohort study consists of 8,111 white adults recruited 1974 to 1978. Participants completed a questionnaire at enrollment with information on personal characteristics. Vital status and cause of death have been updated through 2006 using the National Death Index. Annual $PM_{2.5}$ was measured by study or USEPA monitors depending on the calendar year. We used Cox proportional hazards regression models to estimate hazard ratios (HR) and 95% confidence intervals (CIs). Effect modification by gender, smoking status, education, obesity, and occupational dust and fume exposure was examined in stratified models and with interaction terms.
Results: With 196,547.25 total person-years of follow-up, there were 4,044 deaths, including 1,680 and 318 from cardiovascular disease and lung cancer, respectively. For each 10 µg/m3 increase in $PM_{2.5}$ in the year of death, the HR for cardiovascular and lung cancer mortality was 1.24 (95%CI 1.12-1.36) and 1.36 (95%CI 1.07-1.69) in models adjusted for BMI, smoking, gender, age, calendar time and education. We observed little evidence of effect modification for cardiovascular mortality. For lung cancer, effects were strongest for participants with less than a high school education (HR=1.83), ever smokers (HR=1.44) and those with dust/fume exposure (HR=1.64). However, none of the interaction terms were statistically significant.
Conclusions: In this continued follow-up of the Harvard Six Cities Cohort, $PM_{2.5}$ is associated with increased risk of mortality from cardiovascular disease and lung cancer. Unlike other investigations, no effect modification for cardiovascular mortality was observed and modifiers of the lung cancer association were modest.

Lung Cancer Effect Modification			
High School	HS or greater	1.08 (0.78-1.48)	0.14
	< HS	1.83 (1.26-2.67)	
Smoking	Ever smoker	1.44 (1.13-1.84)	0.94
	Never smoker	1.11 (0.49-2.55)	
Obesity	Obese	1.29 (0.41-4.06)	
	Not obese	1.37 (1.08-1.73)	
Gender	Male	1.47 (1.11-1.95)	0.30
	Female	1.13 (0.75-1.70)	
Dust or Fumes	No	1.07 (0.72-1.59)	0.07
	yes	1.64 (1.20-2.24)	